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ABSTRACT

As a result of a report from the National Commission on Excellence in Education recognizing the crisis in science, math, and technology training, and the increasing need for skilled manpower critical to economic growth and national defense, the federal government has proposed several bills for educational advancement. The President has signed into law over $1.3 billion for the National Science Foundation including $75 million designated for various educational activities, and has made a budget request for $50 million for relieving math and science teacher shortages. Both the House and Senate have standing bills appropriating money for the provision of accessible, quality instruction in the sciences, foreign languages, computer learning, and the training of technical, engineering and scientific personnel. Acting within current programs, the U.S. Department of Education will be awarding $1.6 million to schools using technology to advance learning in teaching the sciences, reading, and writing; has provided extra funds for current "Lighthouse" schools serving as models for other school systems in using technology; has hosted a conference focusing on research in technology; has established a Center for Technology for research purposes; has focused surveys on computer usage in schools; has awarded contracts focusing on benefits of using technology to teach writing and the sciences; and has used educational television to promote scientific knowledge. (DJR)

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Improving the Scientific and Technological Literacy of America's Youth: The National Role

by

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Good morning,

It is indeed a great pleasure to be here this morning speaking before this impressive gathering of the Aerospace Education Foundation. I commend you for taking as the theme of your symposium an issue which will increase in importance and significance over the next few years: "Improving the Scientific and Technological Literacy of America's Youth." I am pleased to have the opportunity to focus on the national role.

First of all, I believe it is important to make a distinction between the national role in education and a federal presence or role in education. Education in the United States is a local activity, a State responsibility, and a national concern. How well a State and locally controlled education system performs is of major concern to our national leadership although there may be a legitimate and ongoing debate in our society on the extent of the federal role and federal presence in that venture. Over ninety percent of the resources for American education are from State and local government with less than ten percent coming from the federal government. Yet, from the Land Ordinance of 1785, the Northwest Ordinance of 1787, to the Land-Grant College Act of 1862 to the Smith-Hughes Act of 1917 for vocational education to the National Defense Education Act of 1958 there have been times when a national role has been identified justifying a federal presence focusing on a limited area of improvement. We are still debating through the executive branch, the legislative branch, and the judicial branch the extent of that federal role in providing aid in such areas as assistance to

English-deficient children in our schools and the obligations under the Education of All Handicapped Children's Act of 1975 (P.L. 94-142). The national role in education does not always require a new program or a new piece of legislation; it may require an identification of certain national problems or a focus on a particular range of objectives which can become or should become a focus of State, local and private efforts in the educational field. Federal assistance might supplement these efforts.

A particular problem in the educational field cannot be isolated for long. In the wake of the launching of Sputnik, a growing concern focused on deficiencies in the American educational system in the major areas of science, math, and foreign language training. These are the "hard" courses which students tend to avoid. Yet, we realized the larger picture in the 1950s and, under the leadership of President Dwight D. Eisenhower, we saw the enactment of the National Defense Education Act providing for strengthening instruction in science, mathematics, and modern foreign language, assistance in guidance and counseling programs as well as long term, and low interest loans to students with a 50 percent forgiveness section for those willing to teach in public elementary and secondary schools. A national consensus had been reached on a program to strengthen the educational resources of American youth.

Today, in response to the new challenge of foreign competition in world trade and urgent defense manpower needs, a new national consensus to strengthen the educational achievement of American youth appears to

turning more toward technology unless we have done a good job of teaching the basics. And we have not performed well in teaching the basics when many of our students are graduating from elementary school, secondary school and even college without the reading and writing skills necessary to function effectively in society; when these same graduates from our secondary schools have only taken one year of math or science as required by many of our states; and when the courses offered by some of our schools have become so devoid of content that they are virtually worthless from an academic standpoint. Unfortunately, it seems many schools have lost sight of the importance of educating individuals to their full mental capacity while developing versatile individuals who can enter our work force to meet the needs of our nation keeping it a strong competitor in the international arena.

The National Commission noted the following:

- a steady decline in science achievement scores of seventeen year olds as measured by national assessments of science in 1969, 1973 and 1977
- College Board achievement scores have revealed steady declines in subjects like physics
- Remedial math courses in 4 year colleges between 1975 and 1980 increased by 72 percent and now constitute one-quarter of all mathematics courses taught in those institutions
- The steady decline in the College Board's Scholastic Aptitude Tests (SAT) from 1963 to 1980 revealed average mathematics scores dropped by nearly 40 points.

be developing. The shortage of trained workers, in basic literacy skills as well as the lack of students with knowledge in the crucial fields of science and math for our future scientists, engineers, and computer specialists cannot be hidden for long as a major problem. It becomes a critical issue in industry and in our national defense establishments when deficiencies show up in the new personnel of the Air Force, Army, Navy and Marines. Such a shortage soon becomes a national crisis of major concern.

Although our presently recognized crisis in science, math, and technology, so well identified in the national defense area by Secretary of the Air Force Verne Orr, has been compared to our situation in the Sputnik era of the 1950s, the situation in many ways is even more critical.

The recent report of the National Commission on Excellence in Education, A National at Risk: The Imperative for Educational Reform, served as a firebell in the night alerting the American people that our educational system has been deficient in meeting our nation's present needs for skilled manpower. The Commission report, supplemented and supported by at least five other reports on the condition of American education, reveals that in the 1960s and 1970s, the focus on loading up the curriculum with "life style courses," emphasis on social promotion, acceptance of grade inflation, an excessive concentration on equity issues, and a proclivity for experimental programs forced out the solid academic subjects in the curriculum of schools throughout our country. We cannot hope to teach the higher complex skills we need in a world

- International comparisons of student achievement completed a decade ago reveal that on 19 academic tests American students never scored first or second, and when compared with industrialized nations, were last seven times.
- And finally, average achievement scores on most standardized tests is now lower than 26 years ago when Sputnik was launched.

One important fact we have learned from the relatively carefree era of the Sputnik-period has been the following: the United States, from the point of view both of economic growth and of national defense, has to outpace its competitors in foreign trade which is a growing portion of our economy. In order to do so skilled manpower is critical to economic growth and national defense in the years before us.

Prior to 1965, only a small proportion of American-made goods were traded internationally; by 1980, more than 70% of all goods produced in the U.S. were actively competing with foreign-made goods.

Twenty years ago, only 2.3% of the American market was absorbed by imports; last year, 5.9%. But in selected areas the figures were much higher. In 1981 America was importing almost 26% of its cars, 25% of its steel, 60% of its televisions, radios, tape recorders and phonographs, and 53% of its numerically controlled machine tools. And between 1970 and 1980, imports from developing nations increased almost tenfold from $3.6 billion to $30 billion (in constant dollars).

For the first time, America is a part of a world economy.

Our economy is not being affected by imports from Western industrial nations alone. Steel and apparel start their travel to these shores from Korea and Hong Kong. You may wonder, what has caused this development?

The answer I think is straightforward. A growing system of private and public banks and monetary institutions has created an international financial market that makes investment capital available to developing, developed and advanced industrial nations alike.

The technology required for the production of standardized products by batch or continuous-flow processes is available for purchase on the open market. This production technology can typically be operated by relatively low-skilled labor.

The result, which we are experiencing, is that producers in foreign nations, with an advantage in either the price of natural resources that are an input to the production process or the price of the low-skilled labor required to operate the process, are able to undersell us in our home market.

The answer to this problem does not lie in assembling foreign cars in the U.S. Through this process, firms of foreign nations such as Japan and Germany use high-priced, high skilled labor at home to produce such components as the engine, electronic ignition, hi-fi stereo radio and radial tires, while paying lower wages to American workers for the lower-skilled labor needed for final assembly of the vehicle.

What I think we should prefer is an economy that uses highly skilled and therefore high-priced and suitably educated labor to produce products such as satellite communication systems, specialty steels and special financial services, and sell these overseas. We can do so while importing lower value-added standardized products and services that can be produced by low-skilled, low-priced labor abroad.

Of course, a high value-added economy will include a large high-tech component, with the additional educational requirement of its skilled manpower for scientific and technological competence.

A growing, high value-added economy that emphasizes high-skilled labor with scientific and technological competence also better prepares the nation militarily for its defense.

In one of its most perceptive passages the National Commission on Excellence noted:

> History is not kind to idlers. The time is long past when America's destiny was assured simply by an abundance of natural resources and inexhaustible human enthusiasm, and by our relative isolation from the malignant problems of of older civilizations. The world is indeed one global village---America's position in the world may once have been reasonably secured with only a few exceptionally well-trained men and women. It is no longer.

President Ronald Reagan has been the first president in twenty-five years to put education back on the national agenda. In a national opinion poll taken in June of this year by the Gallup organization, education was considered the number two issue for the 1984 election

after the issue of unemployment. Other polls have shown a growing concern about education and support from the American people for tougher academic standards. The September issue of Phi Delta Kappan magazine contains results of a Gallup poll revealing that most Americans agree with the recommendations of the National Commission on Excellence in Education. Three-quarters of those polled favored promoting children from grade to grade only if they can pass tests. Poll respondents also favored more homework for students as well as a greater emphasis on math, English, science, U.S. history and government.

However, money alone or new, intrusive federal programs with specific and excessive regulations are not the answer to our education problem. Although money will be needed for some reforms, we must not automatically assume an influx of money will work wonders or if we throw money at the problem, some of it will find good ground and bring positive change. We must not just do more; we need to do things differently. While the objectives may be good and desirable, federal efforts over the preceeding years to promote busing in the name of equity, enforce some unrealistic sex equity rules focusing on student dress codes, and compel a certain teaching method for English-deficient children have distracted us from focusing on the real aim of education: the intellectual betterment of the student. Attempts to elevate "choice" for students as a right between academic and non-academic courses and attempts to substitute "behavior modification" or "values clarification" for intellectual development deter us from following the

steady highway of educational improvement. It is in setting the broad guidelines, providing the directional signals, that the federal government can play a leadership role. The President and the Secretary of Education can use their positions as "bully pulpits" to focus on what should be the essentials of a strong American educational system.

The President highlighted the seriousness of our math and science shortage in his State of the Union message by proposing an education initiative to encourage an upgrading of math and science instruction through a program of block grants to the States. And in his commencement address at Seton Hall University in May of this year, the President stated that there is "much the federal government can do to help set a national agenda for excellence in education, a commitment to quality that can open up new opportunities and new horizons to our young people." And the President promised in the weeks ahead, he would be addressing the specifics of that issue. We may need to wait for President Reagan's State of the Union message and the presentation of the Fiscal Year 1985 budget for highlighting specific areas of focus for action by the national government to improve education.

I would like to focus on two areas along the line of this topic -- what is going on in Congress and what we are doing internally in the Education Department focusing on the problem of the scientific and technological illiteracy of America's youth. We all realize that the problem has been long in the making and it will be long in resolving.

The President signed into law, Public Law 98-45 on July 12, 1983, the HUD-Independent Agencies Appropriations for FY 84. This measure contained over $1.3 billion for the National Science Foundation. There is $75 million of the National Science Foundation budget designated for educational activities. This act specifies $34 million of that $75 million will be used for merit based instructional material development, evaluation, and demonstration activities. In the language of the legislative report of the bill there is indication that approximately $20 million will support 1500 graduate fellowships for undergraduates who wish to pursue graduate education in the sciences. Although the bill does not contain specific instructions for approximately another $20 million, these funds can be used for a variety of activities including research, high technology applications, dissemination and public awareness activities. We will have a better indication of the specifics of the National Science Foundation FY 1984 plan when the NSF Director releases this plan in a few weeks (after October 1st).

Congress has not acted on the Department of Labor, Health and Human Services, and Education and Related Agencies bill which contains funds for the U.S. Education Department. It appears that possibly Congress won't act on the President's budget request and the U.S. Education Department will operate under a Continuing Resolution which essentially would keep the budget for for the Education Department at approximately

$15 billion. It is in the President's budget request that we find his request for $50 million to present a program for relieving the math and science teacher shortage.

There is a math and science bill which has been the focus of attention this session in each house of Congress in the House and in the Senate. The House bill, H.R. 1310, is authorized for a total of $430 million; the Senate bill S. 1285 is authorized at $425 million. The House of Representatives passed its bill on March 2; the Senate bill was reported out of committee on May 16 and final action is expected sometime in the next few weeks or months.

I believe it is reasonable to assume that any legislation enacted this year would bear a resemblance to the provisions of these bills. I am unaware of any explicit message from the President that he will either sign or veto a bill at the $400 million plus level. I am sure he will not make a final decision until he sees the form of the final legislation which clears the Congress.

The House bill is entitled the "Emergency Mathematics and Science Education Act." The bill's purpose is to provide assistance for elementary, secondary, and postsecondary education in math, science, and critical foreign languages; to provide a national policy for engineering, technical, and scientific personnel; and to provide for cost-sharing with the private sector in training such personnel.

The bill contains two titles: Title I, "The Emergency Math and Science Education and Jobs Act" and Title II, "The National Engineering Science Personnel and Jobs Creation Act of 1983." Provisions of

Title I, authorized for two years, include: a $250 million Education Department program of formula block grants to States for the improvement of instruction in elementary and secondary math and science education, a $20 million ED program of teaching incentive scholarships for up to 5,000 persons in FY 1984: and $50 million for a variety of ED and NSF postsecondary activities including teacher grants, summer institutes, research, and program improvement. Title II, authorized at $100 million in FY 1984, provides annual funds to the National Science Foundation for five years for a matching program to promote and develop the quality of the nation's technical, engineering, and scientific personnel.

The Senate bill is entitled the "Education for Economic Security Act." Similar in purpose to the House bill, it is designed to provide assistance to improve the quality of teaching and instruction in math, science, computer learning, and foreign languages and to increase the access to such instruction to all students, and thereby contribute to the strengthening the economic security of the U.S. The bill has four titles: Title I provides $45 million in FY 1984 to the National Science Foundation for teacher institutes, improvement of instructional programs and materials in math and science, excellence awards for teachers, and merit scholarships; Title II, administered by the U.S. Education Department, provides $315 million for block grants to States and local education officials to improve the skills of teachers and instruction in math, science, computer learning, and foreign languages and reserves

$35 million for the Secretary's Discretionary Fund to be used to support programs of national significance, including research and evaluation activities; Title III provides the National Science Foundation with $30 million to form partnerships with the private sector for special projects in math and science education; and finally, Title IV authorizes the President to make awards for teaching and excellence in math and science to 100 secondary school teachers.

The legislative process is never a simple one. There may be some changes in the Senate bill by amendments when it comes up for debate. If the bill passes the Senate, there will have to be a conference committee to iron out the differences between the two bills, specifically a focus on governance, the partnership program, and funding levels. Even after a final bill is acted on by both Houses and the President, it still must be meshed with the appropriations process which is proceeding on a separate track.

However, the Reagan Administration has not been content to wait until Congressional action to deal with the problem. Acting within current programs and with discretionary funds, Secretary Bell has been working to focus current programs in the department on this problem. I can only cite a few examples.

Through the Secretary's Discretionary Fund, the U.S. Education Department will be awarding $1.6 million dollars to approximately ten schools in the country which are using one or more forms of technologies to advance and enhance learning. These schools will be outstanding

models for school systems throughout the country on how to use instructional technology to do a better job of teaching math, science, reading and writing.

The Secretary in previous years has more effectively focused exemplary programs in the National Diffusion Network on those in academic areas of science, math, and technology. Through the NDN, we have provided extra funding for ten "Lighthouse" schools using technology; these funds allow visitors as well as training for other educators to replicate these experiences in their own school systems.

My Office, the Office of Educational Research and Improvement, hosted a conference last November in Pittsburgh of forty experts in the fields of technology, learning psychology, math and science and other areas. These experts focused on what research we will need in future years to make the best use of technology in teaching science, math, reading and writing. We intend to disseminate this report widely when it becomes available this year. I believe it will have a significant impact on school officials at all levels, business and industry leaders, school board members and parents to give a road map on the critical questions we must focus on to use technology effectively in these critical learning areas.

Through the National Institute of Education, we are competing for a Center for Technology which will assist research in technology and through our National Center for Education Statistics we are focusing on surveys exploring how many computers we have in our schools, what

courses students are taking, and how student courses and certification of teachers measure up to the needs identified by the National Commission on Excellence in Education.

The Education Department, through our Center for Libraries and Educational Improvement, has three contracts focusing on the beneficial use of technology in writing, math and science. And we are using educational television to promote scientific knowledge through such Education Department programs as the "Voyage of the Mimi," "3-2-1 Contact," and "Spaces," a television series which shows the relationship between the jobs in the real world of science and relationship to science education.

We at the national, State and local levels cannot remain idle observers as we become aware of an impending crisis for our future leadership role as a nation. We are not competing against merely allies but adversaries who are committed to using technology and leadership in the economic sphere to strengthen totalitarianism and an ideology which denies human liberty. The position of the United States as an economic leader goes hand in hand with its role as a leader of the Free World.

While we at the national level can assist in some major areas of need, we at the national level do not have all the answers nor should we have all the power to bring about change. The leadership of the President, the Secretary of Education, and the members of the National Commission has brought forth a tremendous response from the grassroots.

Through a series of forums, we are hearing the voice of America coming alive and seeking means to improve the educational system of our country. As the National Commission report pointed out, the job has to be done locally but we can still provide the national leadership to highlight the problem and aid in achieving specific goals.

Let our critics continue to undermine the strength our State and local educators, pander to special interest groups, and propose excessive funding for programs unrelated to educational excellence. We shall continue to focus a glaring light of excellence and quality on our school system.

In the Senate Committee on Labor and Human Resources report on the "Education for Economic Security Act," it noted that education can succeed nationally only when responsibility for education is broadly accepted. It notes that the effort to stem the decline of mathematics and science education, a deterioration which "threatens everything we have achieved and hope to achieve as a nation," must come from all levels of society -- families, towns, states, public and private schools and the federal government.

This type of conference focusing on how to improve the scientific and technological literacy of America's youth can play a critical role in helping us to reverse the tide.

Some people may think we can survive this crisis with trusting in luck. We need more than luck. It reminds me of the story of the successful businessman who was asked if he attributed his great success to luck. And he replied "Yes, in a way. I find the harder I work, the luckier I get."

It will take hard work and it will take optimism. People today are seriously discussing the ideas contained in Alvin Toffler's The Third Wave and John Naisbitt's Megatrends; we see books like Thomas J. Peters and Robert H. Waterman's In Search of Excellence and Kenneth Blanchard and Spencer Johnson's The One-Minute Manager, books focusing on self-improvement and excellence, on the best sellers list.

However, it was only three years ago that we heard talk of the enduring energy crisis, the malaise of the American people, and the Global 2000 Report to the President, which spread an aura of pessimism as it talked of worldwide disasters in climate, population, and resources. We are, I believe, retreating away from this pessimism.

This past July, America lost one of its great minds and geniuses of this century with the death of Herman Kahn, a person of compassion and realism. He helped to lead the counterattack against the purveyers of pessimism. In his last book The Coming Boom, Herman Kahn with his usual insight and foresight had this to say:

> "Low morale and anti-growth ideologies affect technology as much as they did other areas. The counter culture movement seems to have peaked, however, resulting in a noticeable return to math and science (as well as an apparent increase in SAT scores) in the high schools.. . . But most important is that the emergence of

> high technology promises to bring back a sense of excitement, achievement, and progress which even astronauts and outer space can no longer elicit." (p. 66)

We cannot afford scientific and technological illiteracy. We shall conquer this our latest crisis. Thank you.